

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-096900

(43)Date of publication of application : 10.04.2001

(51)Int.Cl.

B41M 5/00
B05D 5/04
B05D 7/04
B05D 7/24
B41J 2/01

(21)Application number : 11-275821

(71)Applicant : MITSUBISHI PAPER MILLS LTD

(22)Date of filing : 29.09.1999

(72)Inventor : ASHIDA TETSUYA
TOKUNAGA YUKIO

(54) METHOD FOR PRODUCTION OF INK-JET RECORDING MEDIUM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a method for producing an ink-jet recording medium which is high in ink absorption and transparency.

SOLUTION: In a method for producing an ink-jet recording medium in which an ink receiving layer containing gas phase method silica is applied to a transparent support and dried, the applied ink receiving layer, after being cooled in an atmosphere of 20°C or below, is dried.

LEGAL STATUS

[Date of request for examination]

22.09.2003

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision
of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The manufacture approach of the ink jet record ingredient characterized by drying after cooling the applied ink absorbing layer under an ambient atmosphere 20 degrees C or less in the manufacture approach of the ink jet record ingredient which applies the ink absorbing layer containing a gaseous-phase method silica on a transparence base material, and is dried.

[Claim 2] The manufacture approach of an ink jet record ingredient according to claim 1 that the temperature of said air when drying is 60 degrees C or less.

[Claim 3] The manufacture approach of an ink jet record ingredient according to claim 1 or 2 that the mean particle diameter of the primary particle of said gaseous-phase method silica is 3-10nm, and the specific surface area by the BET adsorption method is more than 250m²/g.

[Claim 4] The manufacture approach of an ink jet record ingredient according to claim 1, 2, or 3 that said transparence base material is polyester film.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention has high ink absorptivity about the manufacture approach of an ink jet record ingredient, and it is related with the approach of manufacturing the ink jet record ingredient excellent in transparency.

[0002]

[Description of the Prior Art] The record ingredient which comes to prepare the ink absorption layer of the porosity which consists pigments, such as amorphous silica, of water-soluble binders, such as polyvinyl alcohol, on the base material called usual paper and a usual ink jet record form as a record ingredient used for an ink jet recording method is known.

[0003] For example, the record ingredient which applies silicon-containing pigments, such as a silica, to JP,55-51583,A, 56-157, 57-107879, 57-107880, 59-230787, 62-160277, 62-184879, 62-183382, a 64-11877 official report, etc. with a drainage system binder like an indication at a paper base material, and is obtained is proposed.

[0004] Moreover, the record ingredient using the synthetic silica particle (a gaseous-phase method silica is called henceforth) by the gaseous-phase method is indicated by JP,3-56552,B, JP,2-188287,A, this Taira No. 132728 [eight to], this Taira No. 81064 [ten to], this Taira No. 119423 [ten to], this Taira No. 175365 [ten to], 10-203006, 10-217601, this Taira No. 20300 [11 to], this Taira No. 20306 [11 to], and this Taira No. 34481 [11 to] official report.

[0005] On the other hand, producing transparence record sheets, such as an OHP film and a film for the 2nd original drawing, by the ink jet recording method is also performed. It is important for these record sheets that transparency is high in addition to the ink absorptivity generally required of an ink jet record ingredient.

[0006] Although said gaseous-phase method silica is a particle therefore, high ink absorptivity and transparency are easy to be acquired. However, in order to acquire still higher ink absorptivity, coverage of a gaseous-phase method silica needed to be made [many], and the binder ratio to a gaseous-phase method silica needed to be made small, and this configuration was reducing transparency. Therefore, amelioration of the ink jet record ingredient which is satisfied with coincidence of ink absorptivity and transparency is desired.

[0007]

[Problem(s) to be Solved by the Invention] The purpose of this invention is to offer the manufacture approach of an ink jet record ingredient with high ink absorptivity and transparency.

[0008]

[Means for Solving the Problem] The above-mentioned purpose of this invention was attained in the manufacture approach of the ink jet record ingredient which applies the ink absorbing layer containing a gaseous-phase method silica on a transparence base material, and is dried by the manufacture approach of the ink jet record ingredient characterized by drying after cooling the applied ink absorbing layer under an ambient atmosphere 20 degrees C or less.

[0009]

[Embodiment of the Invention] Hereafter, this invention is explained to a detail. In this invention, the coating liquid of the ink absorbing layer applied to a transparence base material is the liquid dissolved and distributed by the solvent (a little organic solvent may be included) with which a gaseous-phase method silica, a binder (water-soluble polymer), a cross linking agent, a cationic polymer, a surfactant, etc. make water a subject. Coating liquid is applied so that the spreading layer of the thickness of dozens - 100 micrometers of numbers may be formed on a base material, Subsequently it dries. This invention once cools the ink absorbing layer applied to the transparence base material under an ambient atmosphere 20 degrees C or less, and is dried at a desiccation process after that. Usually, it is kept warm by about 30-50 degrees C, and ink absorbing layer coating liquid before being applied is once cooled after spreading. It was completely unexpected discovery from said conventional technique that high transparency is acquired by this.

[0010] The cooling process which cools the applied ink absorbing layer has a method of passing the inside of the box cooled by 20 degrees C or less, or a method of spraying air 20 degrees C or less on a spreading side. Preferably, it is cooling below 10 degrees C. 10 seconds or more of a cooldown delay are desirable, and it is more desirable. [of 15 seconds or more] It is desirable to cool so that the skin temperature of the applied ink absorbing layer may become 20 degrees C or less at this cooling process.

[0011] As for the desiccation after cooling, it is desirable to dry with air 60 degrees C or less. It is drying with air 55 degrees C or less more preferably. Still higher transparency is acquired by this.

[0012] In a spreading desiccation process, although the air of the low humidity dehumidified in order to usually gather drying efficiency is used, as for this invention, it is desirable that the solid content concentration of a spreading layer dries from 95 % of the weight to desiccation termination with the air of 20 - 60% of relative humidity. Transparency improves further by this. It is 25 - 50% of relative humidity preferably, and is 25 - 45% still more preferably. The solid content concentration of a spreading layer expresses the ratio of the total solids in coating liquid, in a desiccation process, it evaporates, solid content concentration rises gradually, and desiccation ends the solvent in a spreading layer (moisture). As for this invention, it is desirable that the solid content concentration of a spreading layer dries from 95 % of the weight to desiccation termination with the air of the relative humidity of the above-mentioned range in this desiccation process. The temperature of this air has desirable about 27-43 degrees C, and is especially desirable. [of 30-40 degrees C]

[0013] Next, the configuration of the ink absorbing layer of this invention is explained. The ink absorbing layer of this invention contains a gaseous-phase method silica. There are what is depended on a wet method, and a thing to depend on a gaseous-phase method in a synthetic silica. Usually, if it is called a silica particle, a wet method silica will be pointed out in many cases. The silica sol obtained as a wet method silica through the double decomposition and the ion-exchange-resin layer by an acid etc. of ** sodium silicate, or ** -- the colloidal silica obtained by carrying out heating aging of this silica sol -- ** The silica gel used as the three-dimensions-aggregated particle to which the several microns to about 10 microns primary particle carried out siloxane association by making a silica sol gel and changing the generation condition, Furthermore, although heating generation of ** silica sol, a sodium silicate, the sodium aluminate, etc. is carried out and it is obtained, there is a synthetic silicic-acid compound which makes a silicic acid [like] a subject.

[0014] The gaseous-phase method silica used for this invention is also called dry process to a wet method, and, generally is made by flame hydrolysis. Although the approach of burning and specifically making tetrachlorosilane with hydrogen and oxygen is generally learned, silanes, such as methyltrichlorosilane and trichlorosilane, can be used in independent or the condition of having mixed with tetrachlorosilane, instead of tetrachlorosilane. From

Japanese Aerosil, Inc., the gaseous-phase method silica is marketed as a QS type from Aerosil and Tokuyama, Inc., and can come to hand.

[0015] 30nm or less is usually desirable, in order to acquire higher gloss, the mean particle diameter of the primary particle of the gaseous-phase method silica used for this invention is 3-10nm, and it is desirable that the specific surface area by the BET adsorption method uses the thing more than 250m²/g (preferably 250-500m²/g). The BET adsorption method as used in the field of this invention is one of the surface area measuring methods of the fine particles by the gas-phase-adsorption method, and is an approach of asking for the total surface area which a 1g sample has from adsorption isotherm, i.e., specific surface area. Usually, as an adsorption gas, many nitrogen gas is used and most approaches of measuring the amount of adsorption from ** of an adsorbed gas or change of the volume are used. The thing most prominent although the constant-temperature line of child adsorption is probably expressed is the formula of Brunauer, Emmett, and Teller, is called a BET equation and is widely used for surface area decision. The amount of adsorption is calculated based on a BET equation, the area which one admolecule occupies on a front face is applied, and surface area is obtained.

[0016] In this invention, the amount of the gaseous-phase method silica which an ink absorbing layer is made to contain has two or more desirable 13 g/m, and its range of 13 - 30 g/m² is more desirable. As for the ink absorbing layer containing a gaseous-phase method silica, it is desirable to have the binder, in order to maintain the property as a coat. Although various well-known binders can be used as this binder, the hydrophilic binder with which transparency is high and the higher permeability of ink is acquired is used preferably. It is important for a hydrophilic binder to swell at the time of the osmosis in early stages of ink, and not to take up an opening in use of a hydrophilic binder, and a hydrophilic binder with low bloating tendency is comparatively used preferably near a room temperature from this viewpoint. Especially a desirable hydrophilic binder is the polyvinyl alcohol or cation denaturation polyvinyl alcohol of completeness or partial saponification.

[0017] one especially desirable also in polyvinyl alcohol -- whenever [saponification] -- 80 or more parts -- or full saponification is carried out. The polyvinyl alcohol of average degree of polymerization 500-5000 is desirable.

[0018] Moreover, it is polyvinyl alcohol which has the 1-3rd class amino group which is indicated by JP,61-10483,A, for example, and the 4th class ammonium in the principal chain of polyvinyl alcohol, or a side chain as cation denaturation polyvinyl alcohol.

[0019] Moreover, although other hydrophilic binders can be used together, it is desirable that it is 20 or less % of the weight to polyvinyl alcohol. The amount of the hydrophilic binder used with a gaseous-phase method silica has 10 - 30 desirable % of the weight to a gaseous-phase method silica, and its 10 - 26 % of the weight is more desirable. High ink absorptivity is acquired by this.

[0020] Although ink absorptivity improves when a gaseous-phase method silica is contained so much and the content ratio of a hydrophilic binder is made small to a gaseous-phase method silica, as mentioned above, transparency tends to fall. This invention is the features of max [acquire / transparency with such a high configuration].

[0021] As for the ink absorbing layer of this invention, it is desirable to contain a cationic compound. The compound used for the purpose of waterproof amelioration as a cationic compound used for this invention is mentioned. These cationic compounds are in the inclination to reduce transparency when it uses combining a gaseous-phase method silica, therefore this invention raises a water resisting property with a cationic compound, and has the advantage of improving transparency further.

[0022] As a cationic compound used for this invention, a cationic polymer and water-soluble metallic compounds are mentioned, for example. As a cationic polymer, polyethyleneimine, a poly diaryl amine, The poly allylamine, JP,59-20696,A, 59-33176, 59-33177, 59-155088, 60-11389, 60-49990, 60-83882, 60-109894, 62-198493, 63-49478, 63-115780, The polymer which has the 1-3rd class amino group indicated by 63-280681, JP,1-40371,A, 6-234268, 7-125411, the 10-193776 official report, etc. and a quaternary-ammonium-salt radical is used preferably. As for the molecular weight of these cation polymers, 5,000 or more are desirable, and further 5,000 to about 100,000 are desirable.

[0023] The amount of these cationic polymers used is 2 - 7 % of the weight preferably one to 10% of the weight to a non-subtlety particle.

[0024] Water-soluble polyvalent metallic salt is mentioned as water-soluble metallic compounds used for this invention. The water-soluble salt of the metal chosen from calcium, barium, manganese, copper, cobalt, nickel, aluminum, iron, zinc, a zirconium, chromium, magnesium, a tungsten, and molybdenum is mentioned. Specifically For example, calcium acetate, a calcium chloride, formic-acid calcium, A calcium sulfate, barium acetate, a barium sulfate, phosphoric-acid barium, a manganese chloride, Manganese acetate, a formic-acid man gunny hydrate, manganese-sulfate ammonium 6 hydrate, A cupric chloride, an ammonium-chloride copper (II) NI hydrate, a copper sulfate, a cobalt chloride, Thiocyanic acid cobalt, cobalt sulfate, nickel-sulfate 6 hydrate, nickel chloride 6 hydrate, Nickel acetate 4 hydrate, ammonium-nickel-sulfate 6 hydrate, amidosulfuric acid nickel 4 hydrate, An aluminum sulfate, sulfurous-acid aluminum, thiosulfuric-acid aluminum, a polyaluminium chloride, Aluminium nitrate 9 hydrate, the aluminum, the ferrous bromide, Ferrous chloride, a ferric chloride, a ferrous sulfate, ferric sulfate, a zinc bromide, a zinc chloride, Zinc nitrate 6 hydrate, a zinc sulfate, an acetic-acid zirconium, a zirconium chloride, Chlorination zirconium dioxide 8 hydrate, a hydroxysalt-sized zirconium, chromium acetate, Chromium-sulfate, magnesium sulfate, and magnesium chloride 6 hydrate, magnesium citrate 9 hydrate, **** sodium tungstate, a sodium-citrate tungsten, a 12 tongue strike phosphoric acid n hydrate, 12 tongue strike silicic-acid 26 hydrate, a molybdenum chloride, a 12 molybdo phosphoric acid n hydrate, etc. are mentioned.

[0025] Moreover, the basic Pori aluminum-hydroxide compound which is the ** aluminum cation polymer of an inorganic system is mentioned as a cationic compound. basicity -- Pori -- an aluminum hydroxide -- a compound -- a principal component -- the following -- a general formula -- one -- two -- or -- three -- being shown -- having -- for example, -- [-- aluminum -- six -- (-- OH --) -- 15 --] -- three -- + -- [-- aluminum -- eight -- (-- OH --) -- 20 --] -- four -- + -- [-- aluminum -- 13 -- (-- OH --) -- 34 --] -- five -- + -- [-- aluminum -- 21 -- (-- OH --) -- 60 --] -- three -- + -- etc. etc. -- like -- basicity -- a macromolecule -- polykaryotic -- condensation -- ion -- stability -- containing -- **** -- water solubility -- Pori -- an aluminum hydroxide -- it is .

[0026]

[aluminum₂(OH)_nCl_{6-n}]_m .. Formula [3] 1 nAlCl [aluminum (OH)₃] .. Formula 2Aln(OH)_mCl (3n-m) 0<m<3n .. Formula 3 [0027] In the name of [Chemistry / Asada] the polyaluminium chloride (PAC), these things are the names of the Pori aluminum hydroxide (Paho), and are the names of PYURAKEMU WT from Riken Green, and Kamiichi is done by Taki Chemical Co., Ltd. with the same purpose as chemical for water treatment, from other manufacturers, and the object of various grade can obtain them easily from it. Although these commercial items can be used in this invention even if it remains as it is, it is also possible for an unsuitably low object to also have pH, and to adjust and use pH suitably in that case.

[0028] this invention -- setting -- the content in the ink absorbing layer of the water-soluble above-mentioned metallic compounds -- 0.1 g/m² - 10 g/m² -- they are 0.2 g/m² - 5 g/m² preferably.

[0029] The above-mentioned cationic compound can use two or more sorts together. For example, a cationic polymer and water-soluble metallic compounds may be used together.

[0030] Although it is desirable to contain various oil droplets as for the ink absorbing layer in this invention in order to improve the brittleness of a coat, the solubility over the water in a room temperature can make 0.01 or less % of the weight of hydrophobic high-boiling point organic solvents (for example, a liquid paraffin, dioctyl phthalate, tricresyl phosphate, a silicone oil, etc.) and a polymer particle (for example, particle to which the polymerization of the polymerization nature monomers, such as styrene, butyl acrylate, a divinylbenzene, butyl methacrylate, and hydroxyethyl methacrylate, was carried out more than a kind) contain as such an oil droplet. Such an oil droplet can be preferably used in 10 - 50% of the weight of the range to a hydrophilic binder.

[0031] In this invention, a dura mater can be carried out to an ink absorbing layer by the suitable hardening agent in order to raise a water resisting property and dot repeatability. As a concrete example of a hardening agent, the aldehyde system compound like formaldehyde and glutaraldehyde, Diacetyl, the ketone compound like a KURORU 2,4-pentanedione, screw (2-chloro ethylurea)-2-hydroxy - 4, 6-dichloro-1,3,5-triazine, The compound which has a reactant halogen like a U.S. Pat. No. 3,288,775 publication, A divinyl sulfone, a compound with the reactant olefin like a U.S. Pat. No. 3,635,718 publication, N-methylol compound like a U.S. Pat. No. 2,732,316 publication, The isocyanate like a U.S. Pat. No. 3,103,437 publication, U.S. Pat. No. 3,017,280, The aziridine

compounds like this No. 2,983,611 publication, and the carbodiimide system compounds like a U.S. Pat. No. 3,100,704 publication The epoxy compound like a U.S. Pat. No. 3,091,537 publication, and the halogen carboxy aldehydes like mucochloric acid the dioxane derivative like dihydroxy dioxane, chromium alum, a sulfuric-acid zirconium, a way acid, the inorganic hardening agent like way acid chloride, etc. -- it is -- these -- one sort -- or two or more sorts can be combined and it can use. The addition of a hardening agent has 0.01-desirable 10g to water-soluble polymer 100g which constitutes an ink absorbing layer, and are 0.1-5g more preferably.

[0032] In this invention, a surfactant and various well-known additives other than a hardening agent, such as the fixing agent of a coloring color, a color pigment, and an ink color, an ultraviolet ray absorbent, an anti-oxidant, the dispersant of a pigment, a defoaming agent, a leveling agent, antiseptics, a fluorescent brightener, a viscosity stabilizer, and a pH regulator, can also be further added in an ink absorbing layer.

[0033] In this invention, especially the method of application is not limited but the well-known method of application can be used for it. For example, there are a slide bead method, a curtain method, an extrusion method, an air knife method, a roll coating method, a KEDDO bar coating method, etc.

[0034] In this invention, even if the number of ink absorbing layers is one, they may consist of two or more layers. In the case of two or more layers, a layer may be divided by the function. When carrying out coincidence spreading of the ink absorbing layer more than two-layer, the solid content concentration of the sum total of all layers and total coverage are meant.

[0035] As a transparency base material used for this invention, plastic resin films, such as polyester resin like polyethylene terephthalate or polyethylenenaphthalate, diacetate resin, triacetate resin, a nitrocellulose, cellulose ester resin like cellulose acetate, acrylic resin, polycarbonate resin, a polyvinyl chloride, polyimide resin, polysulfone, polyphenylene oxide, cellophane, and celluloid, are mentioned, for example. Especially polyester film is used preferably. The thickness of these resin film base materials has an about about 50-250-micrometer desirable thing.

[0036] It is indicated by JP,5-201118,A, this Taira No. 183135 [six to], this Taira No. 276789 [seven to], this Taira No. 132728 [eight to] official report, etc. as an ink jet record ingredient which prepared the ink absorbing layer which contains a non-subtlety particle in a plastic resin film base material. When applying the coating liquid of an ink absorbing layer to a plastic resin film base material, in advance of spreading, corona discharge treatment, flame treatment, UV irradiation processing, plasma treatment, etc. are usually performed. Moreover, although the ink jet record ingredient which prepared the primer layer which consists of synthetic resin on polyester film is indicated by JP,6-270531,A, the ink absorbing layer using the target gaseous-phase [this invention] method silica is not indicated.

[0037] As for this invention, it is desirable to prepare the primer layer which makes synthetic resin a subject on a transparency plastic resin film base material. After applying the ink absorbing layer which consists of a gaseous-phase method silica on this primer layer, transparency improves further by cooling and drying at low temperature comparatively.

[0038] The primer layer prepared on a resin film makes synthetic resin a subject. As synthetic resin to apply, acrylic resin, polyester resin, a vinylidene chloride, vinyl chloride resin, vinyl acetate resin, polystyrene, polyamide resin, polyurethane resin, etc. are mentioned. Also in these, acrylic resin, polyester resin, vinylidene chloride resin, and polyurethane resin are especially desirable. As acrylic resin, the homopolymers or these copolymers of acrylic-acid alkyl ester and alkyl methacrylate ester are common. As polyester resin, a polycondensation object with polybasic acid, such as a glycol (for example, ethylene glycol, a diethylene glycol), aliphatic series, or an aromatic series dibasic acid, is common. As vinylidene chloride resin, a copolymer with a homopolymer or acrylic-acid alkyl ester, alkyl methacrylate ester, and/or acrylonitrile is desirable. As polyurethane resin, a moisture powder type polyurethane emulsion is desirable. Although these resin can be applied on a base material as the solution or water solution of an organic solvent, it is a desirable water-dispersion polymer and is applying on a base material as an emulsion or a latex.

[0039] These synthetic resin is contained 60% of the weight or more to the total solids which constitute a primer layer. It contains 80% of the weight or more preferably. Furthermore, in a primer layer, water-soluble polymers, such as particles, such as cross linking agents, such as a surfactant, isocyanate, and epoxy, and colloidal silica, gelatin, and polyvinyl alcohol, can be contained.

[0040] The above-mentioned primer layer is prepared by 0.01-5-micrometer thickness (desiccation thickness) on a base material. It is the range of 0.05-5 micrometers preferably.

[0041] Various kinds of back coat layers can be painted on the base material in this invention for antistatic nature, conveyance nature, curl tightness, etc. A back coat layer can be made to contain combining suitably an inorganic antistatic agent, an organic antistatic agent, a hydrophilic binder, a latex, a curing agent, a surfactant, etc.

[0042]

[Example] Hereafter, although an example explains this invention in detail, the contents of this invention are not restricted to an example.

[0043] The base material shown in the example 1 following was prepared.

What carried out oxygen plasma treatment of the front face of a polyethylene terephthalate film with a <base material A> thickness of 100 micrometers.

On the polyethylene terephthalate film with a <base material B> thickness of 100 micrometers, the primer layer of the following presentation was prepared so that desiccation thickness might be set to 0.3 micrometers.

primer layer: -- vinylidene-chloride: -- methyl acrylate: -- the latex (weight average molecular weight 42000) of an acrylic acid (90:9:1, weight %).

[0044] On the two above-mentioned kinds of base materials, the ink absorbing layer coating liquid of the following presentation was applied with the slide bead coater, and it dried. The ink absorbing layer coating liquid shown below was prepared so that a gaseous-phase method silica might become 8.5% of the weight of solid content concentration, and hygroscopic-moisture coverage applied it by 200 g/m².

[0045]

<Ink absorbing layer coating liquid> gaseous-phase method silica The 100 sections (specific-surface-area 300m²/g by the first [an average of] particle size of 7nm, and the BET adsorption method)

Dimethyl diaryl ammoniumchloride homopolymer 4 section way acid 4 section polyvinyl alcohol The 20 sections (whenever [saponification] 88%, average degree of polymerization 3500)

Surfactant The 0.3 sections [0046] The desiccation conditions after spreading are shown below.

After cooling and total-solids concentration dried even 90 % of the weight by 45-degree-C10%RH for 20 seconds at 1> 5 degrees C of < desiccation conditions, and, subsequently it dried by 35-degree-C30%RH.

After cooling and total-solids concentration dried even 90 % of the weight by 45-degree-C10%RH for 20 seconds at 2> 5 degrees C of < desiccation conditions, and, subsequently it dried by 50-degree-C10%RH.

<Desiccation conditions 3> It dried by 60-degree-C20%RH, without cooling.

[0047] The following evaluation was performed about the ink jet record sheet created as mentioned above. The result is shown in Table 1.

[0048] Using a <ink absorptivity> plotter (Novajet-PRO42e made from ENCAD), and GS ink, C, M, and Y were printed at 100%, respectively, the PPC form was lightly stuck to the printing section by pressure in piles immediately after printing, extent of the amount of ink imprinted in the PPC form was observed visually, and the following criteria estimated.

O : don't imprint at all.

** : Imprint a little.

[0049] < transparency: It measured using the haze value > POIKKU integrating-sphere type hazemeter (product made from Japanese Precision Optics).

[0050]

[Table 1]

----- base material Desiccation conditions Ink absorptivity Haze (%) Note ----- A 1 O 15.6 This invention A 2 O 17.3
This invention A 3 O 21.7 Comparison B 1 O 11.6 This invention B 2 O 13.4 This invention B 3 O 19.5 Comparison ----- [0051]
[Effect of the Invention] According to the manufacture approach of the ink jet record ingredient of this invention, transparency is high (a haze value is low),
and the high record ingredient of ink absorptivity is obtained so that clearly from the above-mentioned result. It improves further by preparing the primer layer
which makes synthetic resin a subject especially.

[Translation done.]